# Biostatistical Data Acquisition in the Menhaden Fisheries

Gene R. Huntsman and Robert B. Chapoton

*Made in United States of America*
Reprinted from Transactions of the American Fisheries Society
Vol. 102, No. 2, April 1973
pp. 452–456

# Biostatistical Data Acquisition in the Menhaden Fisheries

GENE R. HUNTSMAN AND
ROBERT B. CHAPOTON
*National Marine Fisheries Service*
*Atlantic Estuarine Fisheries Center*
*Beaufort, North Carolina 28516*

ABSTRACT

Methods of recording and processing data from collections of Atlantic menhaden (*Brevoortia tyrannus*) and Gulf menhaden (*B. patronus*) from commercial menhaden landings are described. Keys to efficient data handling are (1) a system of two data cards and (2) a code system for information about the sampled fish. The data are stored on magnetic tape and can be displayed in many useful arrays by a number of computer programs written in American Standard Cobol for the IBM 360 (Model 65).

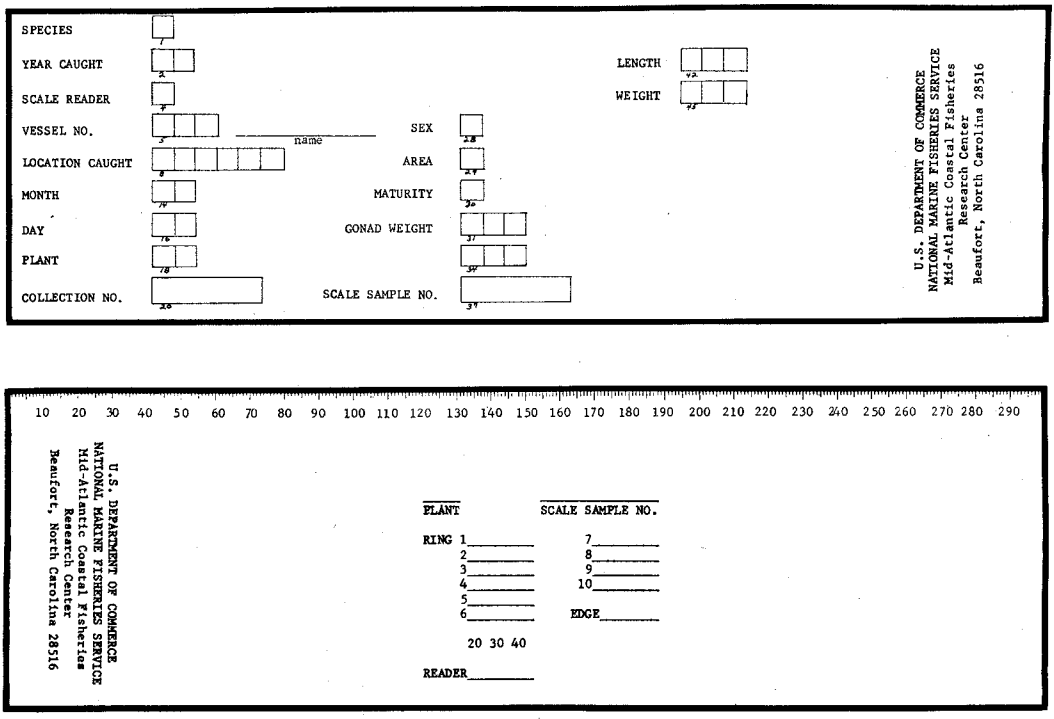


FIGURE 1.—Data cards used in processing samples from the menhaden fisheries. The sample card is above, the scale card below.

## INTRODUCTION

A prominent feature of the National Marine Fisheries Service menhaden research program, begun in 1955, is intensive and extensive sampling of menhaden landings at ports from Maine to Texas. The fisheries for the two commercially important menhaden species, *Brevoortia tyrannus* on the Atlantic coast and *B. patronus* in the Gulf of Mexico, comprise 19 ports on two coasts, approximately 150 vessels, and around 5,000 vessel unloadings per year. The record annual catch of both menhaden was 1,033,000 metric tons, representing an estimated 10 billion individual fish, in 1961.

Sampling this large fishery has involved processing as many as 50,000 fish, scale samples, and sets of associated data per season. An efficient system of data acquisition and management is essential to the success of the research program. A description of our present data management system, the product of an expensive evolution, should be of value to others planning research on large commercial fisheries.

Data acquisition begins with sampling fish landed by the purse seine vessels. Sampling procedures are essentially those reported by June and Reintjes (1959). Samplers, located at most ports, obtain samples, each of 20 fish, from a minimum of 10 landings during each week.

Effective data management must begin upon processing the fish samples to ensure an orderly, efficient flow of information to the data processing unit and ultimately to data users. Our keys to efficient data transmission are two data cards (Fig. 1) and a code system (Table 1) for pertinent information about the samples. One data card, a sampling card, is for catch and morphometric information; the other, the scale card, is for scale and age information. The cards measure 3½ inches by 11¾ inches and cost less than 1 cent each.

To simplify operations for the sampler we

TABLE 1.—*Format and code numbers for recording data on sampled fish*

| Field name | Field size | Limits | Code and observation |
|---|---|---|---|
| Species | 1–1 | Ø–9 | Ø *B. tyrannus* and *B. patronus*, 2 *B. smithi*, 3 *B. gunteri*, . . . 6 *Opisthonema oglinum*, etc. |
| Year caught | 2–3 | Ø–99 | last two digits of year |
| Scale reader | 4–4 | Ø–9 | number assigned |
| Vessel | 5–7 | ØØ1–999 | number assigned |
| Latitude | 8–9 | Ø1–99 | degrees latitude caught |
| Longitude | 10–11 | Ø1–99 | degrees longitude caught |
| Alpha coordinate | 12–12 | A–F | 10 minutes of latitude |
| Number coordinate | 13–13 | Ø–6 | 10 minutes of longitude |
| Month | 14–15 | ØØ–12 | 1 January, 2 February, etc. |
| Day | 16–17 | Ø–31 | day of month |
| Plant | 18–19 | Ø1–99 | number assigned |
| Collection number | 20–23 | ØØ1–999 | number of 20-fish collection |
| Number of rings | 24–25 | Ø1–19 | number of annuli on scales |
| Year-class | 26–27 | Ø1–99 | year hatched or year caught minus number of annuli, 20 no fish sampled, 30 no scale, 40 illegible scale |
| Sex | 28–28 | Ø1–9 | 1 male, 2 female, 3 unknown |
| Large area along coast | 29–29 | Ø–9 | 1 North Atlantic, 2 Middle, 3 South, etc. |
| Sexual maturity | 30–30 | Ø–9 | 1 immature, 2 resting, 3 ripening, 4 ripe, 5 spent, 6 unknown |
| Gonad weight | 31–33 | Ø–999 | weight to tenth of gram |
| Gear | 34–34 | Ø–9 | Ø purse seine, 1 pound net, 2 gill net, 3 trawl |
| Blank | 35–35 | — | — |
| Blank | 36–36 | — | — |
| Scale sample | 37–41 | Ø–99999 | number assigned each sampled fish, consecutive for year |
| Length | 42–44 | Ø–999 | fish fork length in mm |
| Weight | 45–47 | Ø–999 | fish weight in grams |
| Scale measurement (1–10) | 48–50—75–77 | Ø–999 | distance in mm of each annulus from focus |
| Scale edge | 78–80 | Ø–999 | distance in mm of scale's margin |

supply bundles of 20 (to match sample size) sampling cards with a collection number and individual fish number printed on each. Spaces for these numbers are located near the bottom of the sampling card to permit easy number insertion with handheld printing machines. When processing a sample, the sampler writes on the first card of the collection the code numbers that apply to all fish in that sample (species, vessel, location caught, date, and plant) as well as the codes describing the first fish (length, weight, sex, sexual maturity stage, and gonad weight). On each of the subsequent 19 cards he writes only the code numbers describing the respective fish. Key punch operators add the information common to all fish in a sample (from the first data card to the information unique to each fish in that sample when the data are prepared for storage on magnetic tape).

The sampler removes and cleans several scales from each fish and mounts them between two glass slides (June and Roithmayr, 1960). Scale mounts are numbered in accordance with the sampling cards and receive both a plant number and scale number. Collections of data cards and of mounted scales are mailed in padded envelopes to our research center at Beaufort, N. C., where collections are logged in and cards and scales are examined to ensure that field personnel are keeping their collections in order.

The scale card is completed at the laboratory. For each sampling card and associated scale mount there exists a scale card bearing the same scale number. As the reader views the enlarged (40×) scale image, he marks the annuli and edge measurement on the ruler edge of the scale card (Fig. 2). Processing of scale cards is completed when the scale measurements and appropriate plant code number is written on the face of the card.

The two-card system has two advantages: (1) it spreads the work load of key punch operators evenly over the year. As sample cards arrive at the laboratory during the fishing season, all information except age, year-class, and scale measurements are key punched and stored on magnetic tape. After the scales have been read, the additional information, plus plant and scale number, are punched and stored on another tape. Data from each tape are matched electronically by plant and scale number to create a third tape on which a complete record for each fish is recorded. (2) the two-card system allows the practice of the system of scale reading in which readers have no knowledge of the size of the fish, date of capture or other informa-

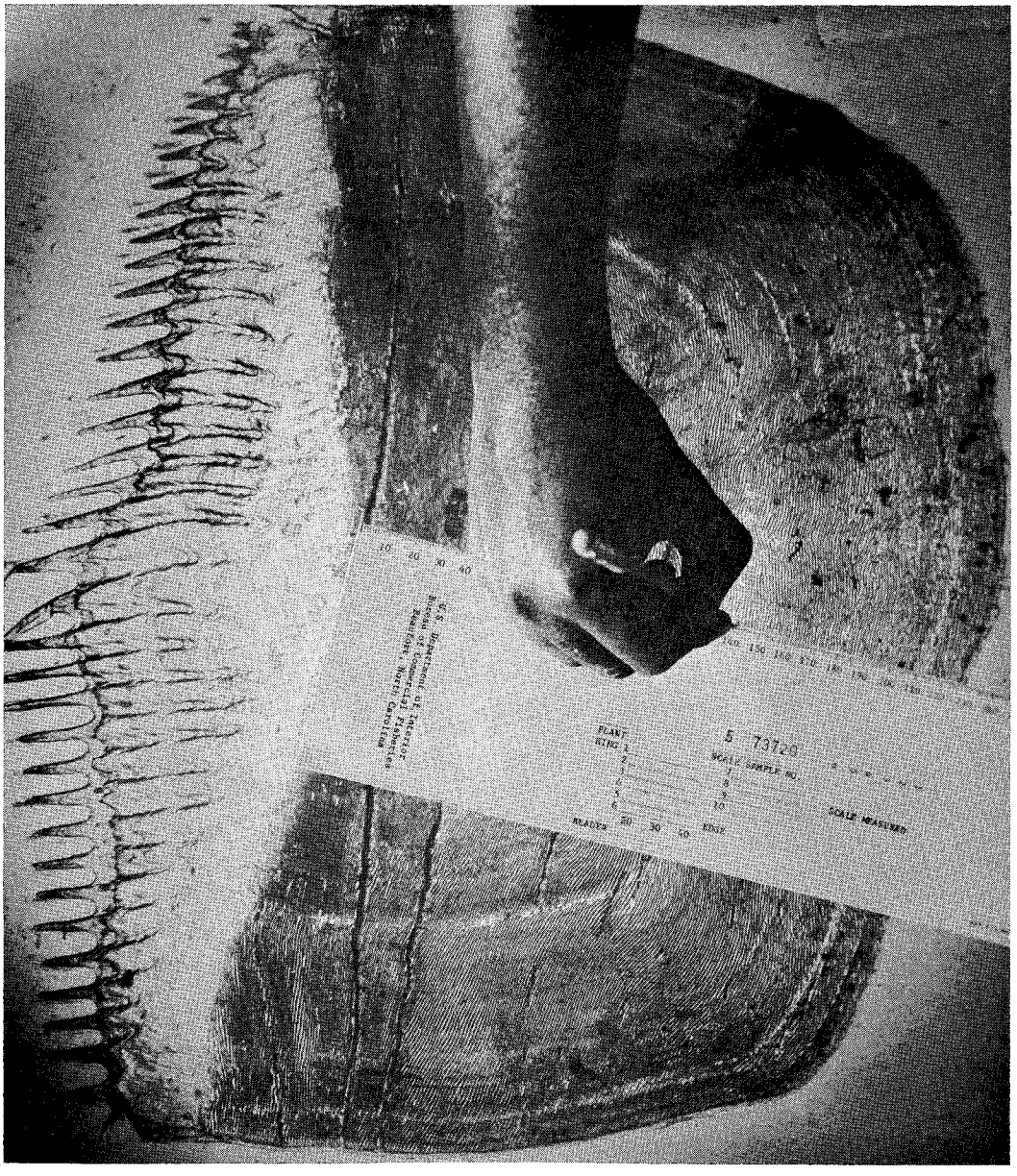

FIGURE 2.—Scale reader marking annulus measurement on the edge of a scale card.

tion, and are supposedly less prone to bias in their aging.

Once the data are on tape they are available for display in many useful arrays, and we have a large library of computer programs (written in American Standard Cobol for the IBM 360 model 65) for generating these arrays. Source decks and documentation of these programs are available to those with genuine interest and need. An annotated partial list of these programs follows.

BST 10; Calculated fish lengths. For each fish, estimated length at each year (annulus is computed. $Ln = (\frac{L}{S_e})$

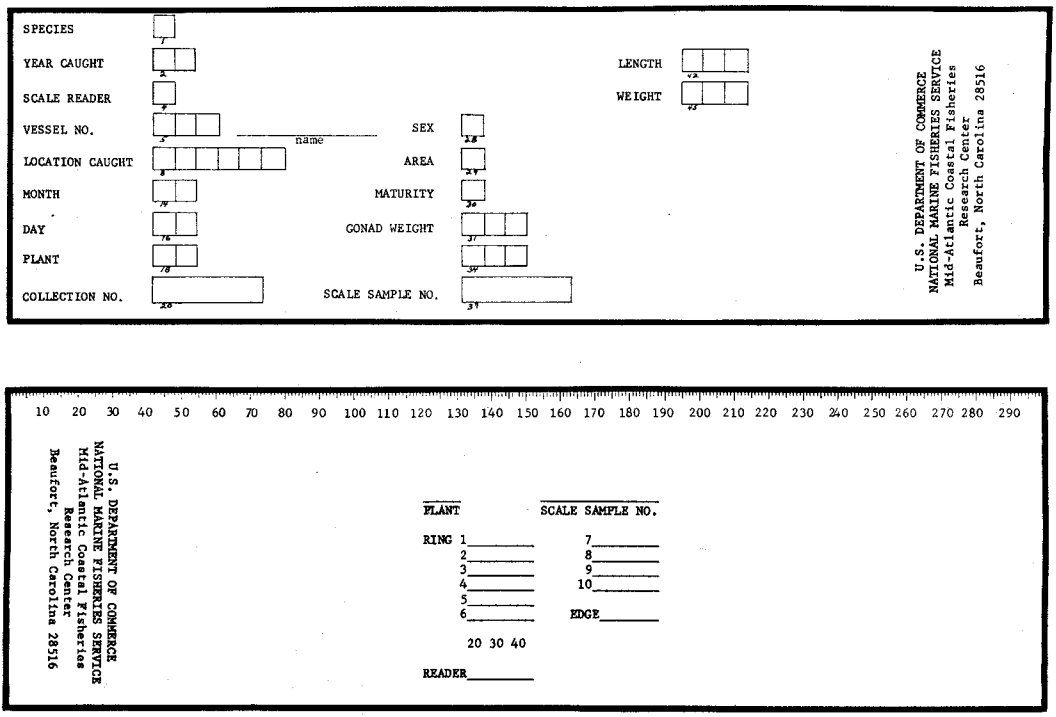


FIGURE 1.—Data cards used in processing samples from the menhaden fisheries. The sample card is above, the scale card below.

## INTRODUCTION

A prominent feature of the National Marine Fisheries Service menhaden research program, begun in 1955, is intensive and extensive sampling of menhaden landings at ports from Maine to Texas. The fisheries for the two commercially important menhaden species, *Brevoortia tyrannus* on the Atlantic coast and *B. patronus* in the Gulf of Mexico, comprise 19 ports on two coasts, approximately 150 vessels, and around 5,000 vessel unloadings per year. The record annual catch of both menhaden was 1,033,000 metric tons, representing an estimated 10 billion individual fish, in 1961.

Sampling this large fishery has involved processing as many as 50,000 fish, scale samples, and sets of associated data per season. An efficient system of data acquisition and management is essential to the success of the research program. A description of our present data management system, the product of an expensive evolution, should be of value to others planning research on large commercial fisheries.

Data acquisition begins with sampling fish landed by the purse seine vessels. Sampling procedures are essentially those reported by June and Reintjes (1959). Samplers, located at most ports, obtain samples, each of 20 fish, from a minimum of 10 landings during each week.

Effective data management must begin upon processing the fish samples to ensure an orderly, efficient flow of information to the data processing unit and ultimately to data users. Our keys to efficient data transmission are two data cards (Fig. 1) and a code system (Table 1) for pertinent information about the samples. One data card, a sampling card, is for catch and morphometric information; the other, the scale card, is for scale and age information. The cards measure 3½ inches by 11¾ inches and cost less than 1 cent each.

To simplify operations for the sampler we